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Agnostopelma: a new genus of tarantula without a scopula on leg IV (Araneae: Theraphosidae: Theraphosinae)

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Abstract. The new genus *Agnostopelma* Pérez-Miles & Weinmann is proposed for the type species *A. tota* n. sp. and *A. gardel* n. sp. from Boyacá, Colombia. *Agnostopelma* build shelters under stones at high elevation. The new genus is unusual in lacking tarsal scopulae on its posterior legs and in having few labial cuspules and short leg tarsi in females.

Keywords: Colombia, spider legs, spider systematics

Taxonomists have considered the presence of scopulae on the metatarsi and tarsi of legs I–IV an important synapomorphy of the Theraphosidae, with a parallelism in the Barychelidae (Raven 1985, 1994; Pérez-Miles et al. 1996). They interpreted the presence of dense tarsal scopulae as synapomorphic for most subfamilies of Theraphosidae, with exception of Ischnocolinae (Raven 1985). Goloboff's cladogram (1993:fig. 27, table 4) indicated that the presence of dense tarsal scopulae on the anterior legs is a synapomorphy of Theraphosinae + *Ischnocolus*.

The condition of the tarsal scopulae has been an important taxonomic tool within Theraphosidae, intensively studied for more than a century (Simón 1892; Pocock 1897; Gerschman de Pikelin & Schiapelli 1973; Raven 1985; Pérez-Miles 1994; Guadanucci 2005). In several groups, the condition varies over ontogenetic development, being divided in juveniles and becoming entire in adults (Gerschman de Pikelin & Schiapelli 1973; Pérez-Miles 1994). The characteristics of the scopulae (entire or divided) were used to diagnose subfamilies and genera, but Pérez-Miles (1994) found that divided scopulae were usually present in small theraphosids, while the entire form was present in large tarantulas, bringing its phylogenetic value into question. Guadanucci (2005) did not confirm this trend in the Ischnocolinae, where scopula condition could contribute valuable phylogenetic information. Previously unpublished data also showed some exceptions to Pérez-Miles' (1994) results in the Theraphosinae. For these reasons, tarsal scopula condition seems an important characteristic to be considered in phylogenetic studies of Theraphosidae, followed in the methodology of Guadanucci (2005).

Examining spiders collected by collaborators in the Departmento de Boyacá, Colombia and by one of us (DW), we noted that some specimens of Theraphosidae lack the usual tarsal scopulae on legs IV (Figs. 1, 2). Ventral faces of tarsi IV are mainly covered by conical setae that are not orthogonal to the cuticle surface; intercalated to these, there are few setae with curved apices similar to scopulae setae but not erected. This could be an extreme case of anterior-posterior gradation as indicated by Raven (1985) for some leg characters in the Mygalomorphae.

These specimens share the main synapomorphies of the Theraphosinae: extended subtegulum, keels on palpal organ, and Theraphosinae types of urticating hairs, which suggest that these spiders are a new genus placed in this subfamily. Male and female of the type species and a second species of this new genus are here described.

METHODS

Abbreviations.—AME = anterior median eyes, ALE = anterior lateral eyes, PME = posterior median eyes, PLE = posterior lateral eyes, OQ = ocular quadrangle (including lateral eyes), d = dorsal, p = prolateral, r = retrolateral, v = ventral, FCE = arachnological collection of the Facultad de Ciencias, Montevideo, Uruguay. All measurements are in millimeters, geographical coordinates in parentheses are approximate, and not taken by GPS. Spination description follows Pérez-Miles (1998) and Pérez Miles & Locht (2003). Drawings were made with a camera lucida.

SYSTEMATICS

Family Theraphosidae Thorell 1869

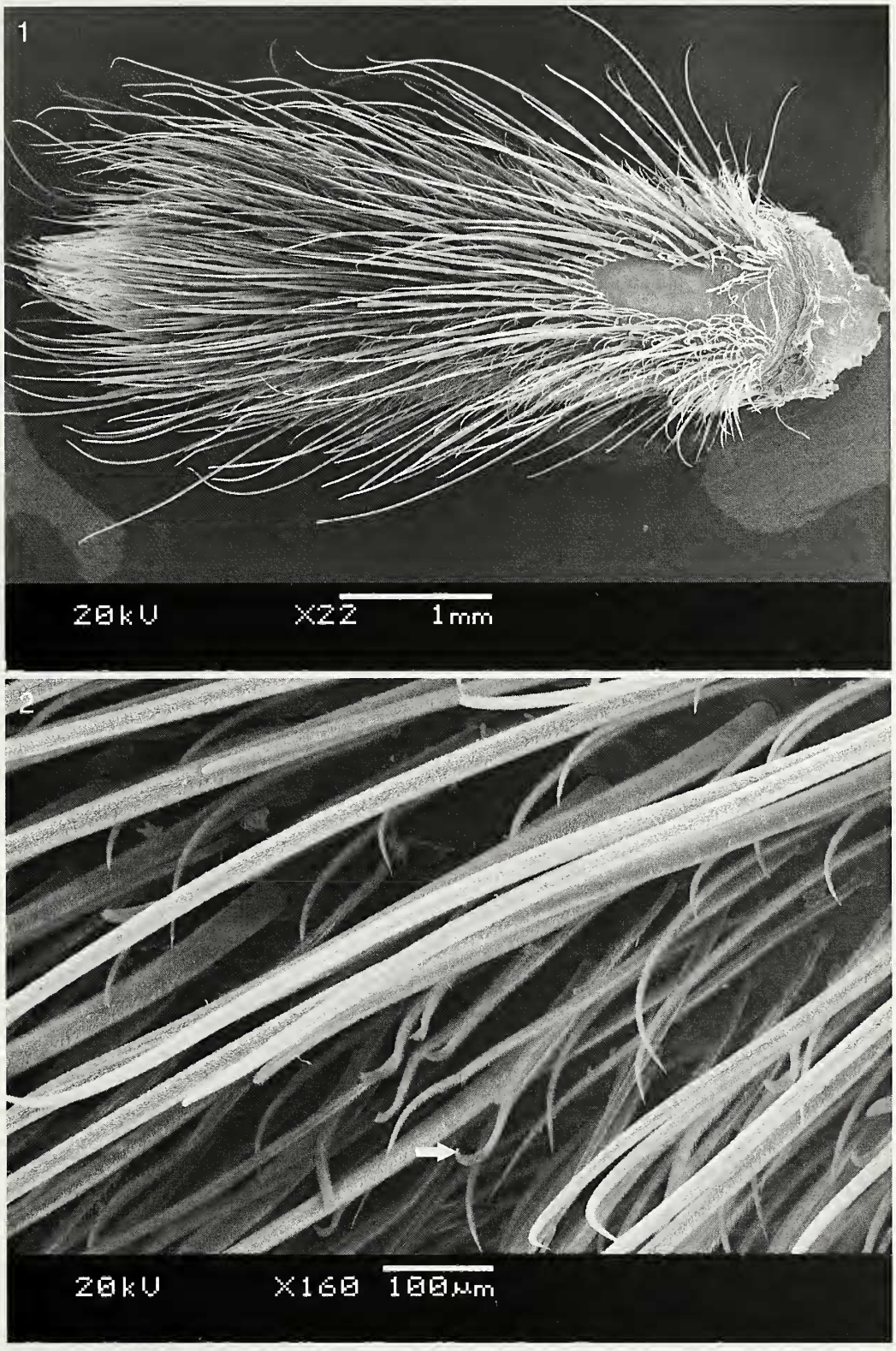
Agnostopelma Pérez-Miles & Weinmann new genus

Type species.—*Agnostopelma tota* Pérez-Miles & Weinmann new species

Etymology.—*Agnostopelma* (neuter) is a eomposition of two Greek words: *Agnostos*, which means "unknown" and *pelma*, which means "sole of the foot." The name makes reference to the absence of scopulae on leg IV of this tarantula, which is unusual in Theraphosidae.

Diagnosis.—Differs from other known genera of Theraphosidae except the Ischnocolinae genus *Acanthopelma* in the absence of tarsal scopulae on legs IV; from *Acanthopelma* in the presenee of abdominal urticating setae, keels on palpal organ and the absence of rigid spines on ventral tarsi; and from most genera of Theraphosinae in the reduced number of labial cuspules. Additionally, females differ from most genera exeept *Magulla* Simon 1892 in their very short tarsi. Also differs radically from *Magulla* in the absence of male tibial apophysis and in the morphology of palpal organ and spermathecae.

Description.—Medium-sized spiders. Carapace oval to subcircular, slightly hirsute, with longer marginal hairs. Eye tubercle distinctly sub-rectangular, clypeus narrow, anterior row of eyes procurved, posterior recurved, a group of strong setae present on the median anterior margin of the tubercle. Eye tubercle oval, wider than long (Fig. 3). Fovea transverse, straight. Chelicerae without rastellum, strong, with teeth on



Figures 1, 2.— *Agnostopelma tota* female. 1. (Top) Tarsus of right leg IV, ventral view; 2. (Bottom) Close-up of setae (arrow shows curved hairs).

the promargin and smaller teeth in the retromargin (except female *A. tota*), intercheliceral tumescence absent in males. Labium wider than long, with 1–6 cuspules on the subapical margin (Fig. 4). Labiosternal groove narrow, homogeneous. Maxillae with the prolateral distal angle very pronounced, 46–121 cuspules present on prolateral proximal angle. Sternum oval, elongated in both sexes (Fig. 5); six oval sternal sigilla, posterior separated from the margin by almost one length. Stridulatory apparatus absent. Spination as in species description. Male without tibial apophysis. Female with leg

Figure 3.—*A. tota* male, ocular tubercle (scale = 1 mm).

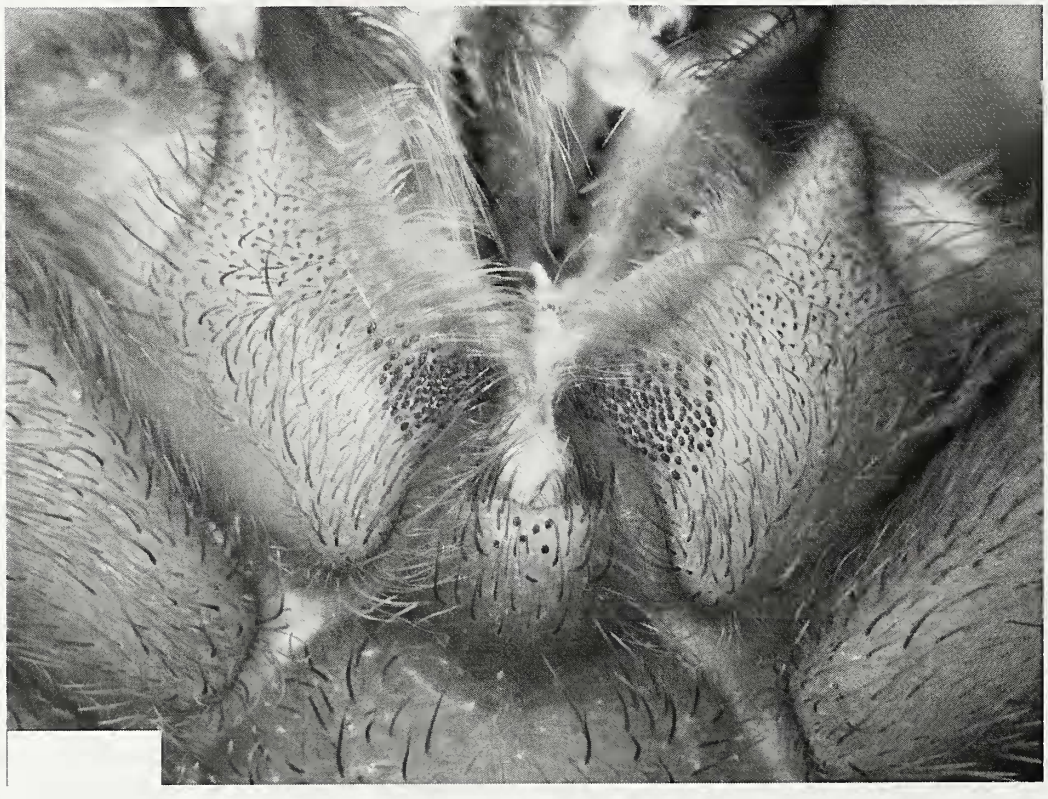


Figure 4.—*A. tota* male, labium and maxillae (scale = 1 mm).

Figure 5.—*A. tota* male, sternum (scale = 1 mm).

tarsi shorter than patellae. Scopulae retrolateral, absent on femur IV. Dense scopulae on tarsi I, II; slight scopulae on tarsi III; tarsi IV without scopulae, with long, conical setae and few shorter, curved setae (Figs. 1, 2). Metatarsi I and II scopulate on their distal portion, III and IV ascopulate. Tricobothria of three types on tarsi, clavate short, filiform long, and fusiform medium sized in a disordered dorsal longitudinal pattern. Metatarsi and tibiae with only filiform tricobothria in a median, longitudinal, dorsal stripe. Third claw absent on all tarsi. Two tarsal claws with 3 teeth in a median ventral line. Claw tufts dense, bilobate, present on all tarsi. Four spinnerets: PLS with three segments, apical digitiform, PMS mono-segmentated.

Distribution.—Colombia: Boyacá: Mongui, Laguna de Tota, Belén.

Agnostopelma tota Pérez-Miles & Weinmann new species
Figs. 1, 2, 3–10, Tables 1, 2

Types.—COLOMBIA: Holotype male, *Dep. Boyacá*: Mongui (5°43′11″N, 72°50′0″W), 2 August 1997, D. Weinmann & F. Pribik. Paratypes: 1 female and 2 males from the same locality as the holotype and a female from *Dep. Boyacá*: Laguna de Tota (5°36′34″N, 72°53′56″W), 6 March 1994, D. Weinmann. All specimens deposited in FCE.

Etymology.—The specific epithet is a noun in apposition, which refers to the name of a lake sacred to the Muisca indigenous people (of the linguistic family of the Chibchas) and the place where one of the paratypes was captured.

Diagnosis.—Males differ from *A. gardel* (see below) in the absence of clear bands in leg articulations and by the greater number of maxillary cuspules (108–121); females differ in the spermathecal receptacles fused at their basis (Fig. 10).

Description.—*Holotype male* (Fig. 6): Total length, not including chelicerae or spinnerets, 17.9. Carapace length 8.5,

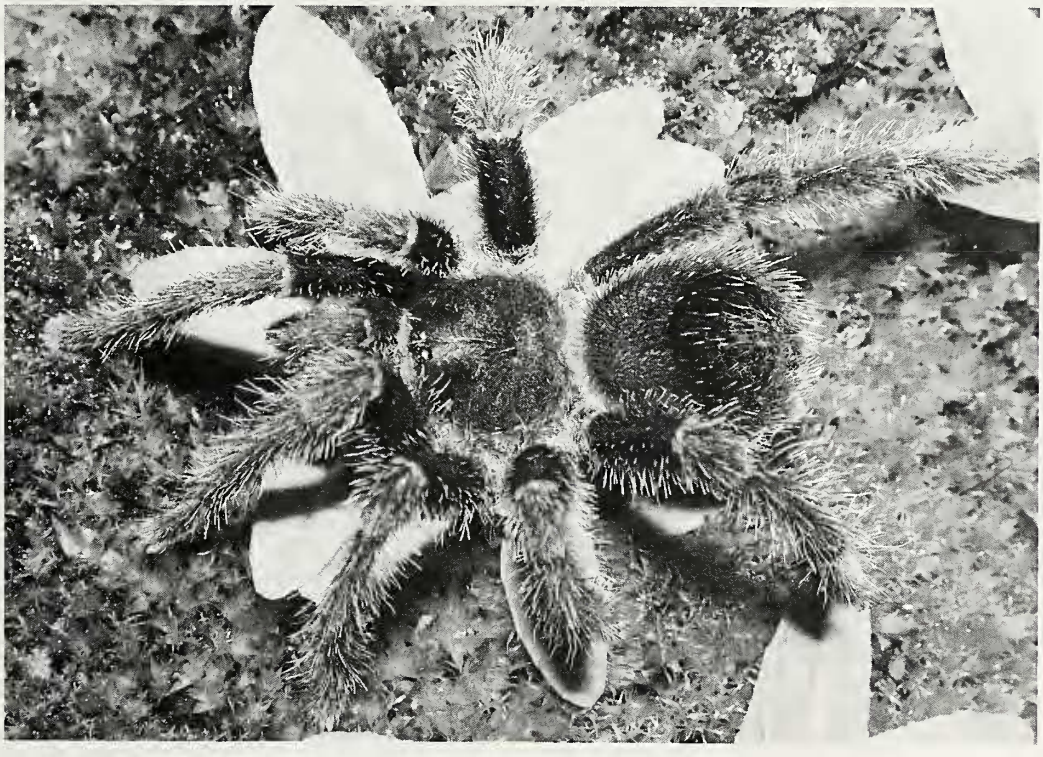
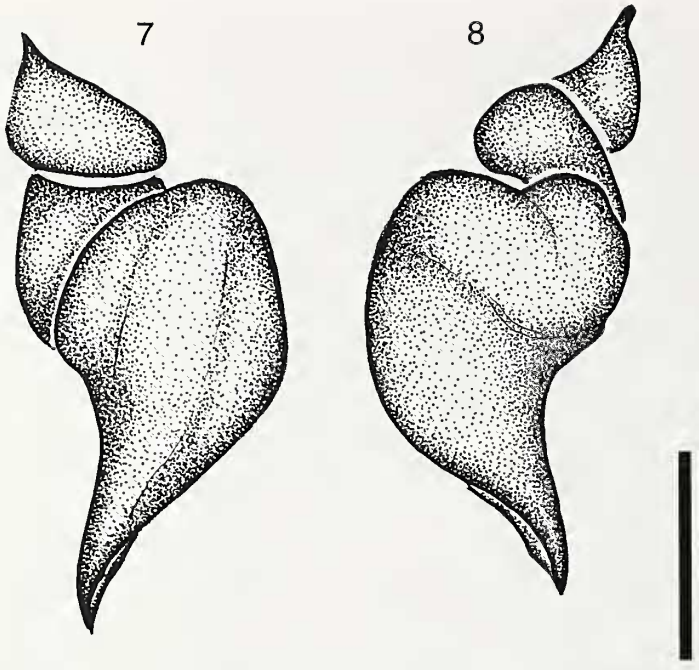


Figure 6.—*A. tota* male, habitus.



Figures 7, 8.—Right palpal organ of male *A. tota*. 7. (Left) Prolateral view; 8. (Right) Retrolateral view (scale = 1 mm).

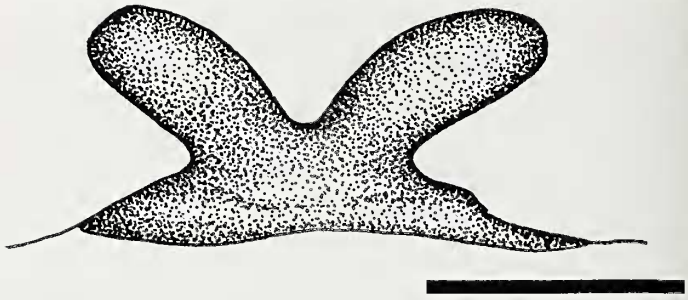


Figure 10.—Spermathecae of female *A. tota*, ventral view (scale = 1 mm).

width 8.3. Anterior eye row slightly procurved, posterior recurved. Eyes sizes and interdistances: AME 0.30, ALE 0.56, PME 0.30, PLE 0.50, AME–AME 0.30, AME–ALE 0.08, PME–PME 0.72, PME–PLE 0.04, ALE–PLE 0.14, OQ length 0.86, width 1.56, clypeus 0.20. Fovea transverse straight, width 1.40. Labium sub-semicircular, anterior edge curved, length 1.30, width 1.40, with 6 cuspules in a group in the center of the anterior half. Maxillae sub-rectangular, anterior prolateral and posterior retrolateral angles produced, with 121/108 cuspules in a group on the proximal prolateral angle. Sternum length 4.4, subcircular, posterior sigilla oval, narrow, submarginal, long setae on margins. Chelicerae with 11 teeth on basal promargin, 5–7 basal retrolateral teeth smaller, intercheliceral tumescence absent. Scopulae: tarsi I–II densely scopulated; I distally divided with longer conical setae; II divided by wide band of such setae; III slightly scopulate, divided by longer conical setae; and IV without scopulae, with long conical setae and lower layer of few curved setae (as in female, Figs. 1, 2). Metatarsi I and II scopulate on their apical half, III and IV not scopulate. Tibia I without apophysis. Palpal organ

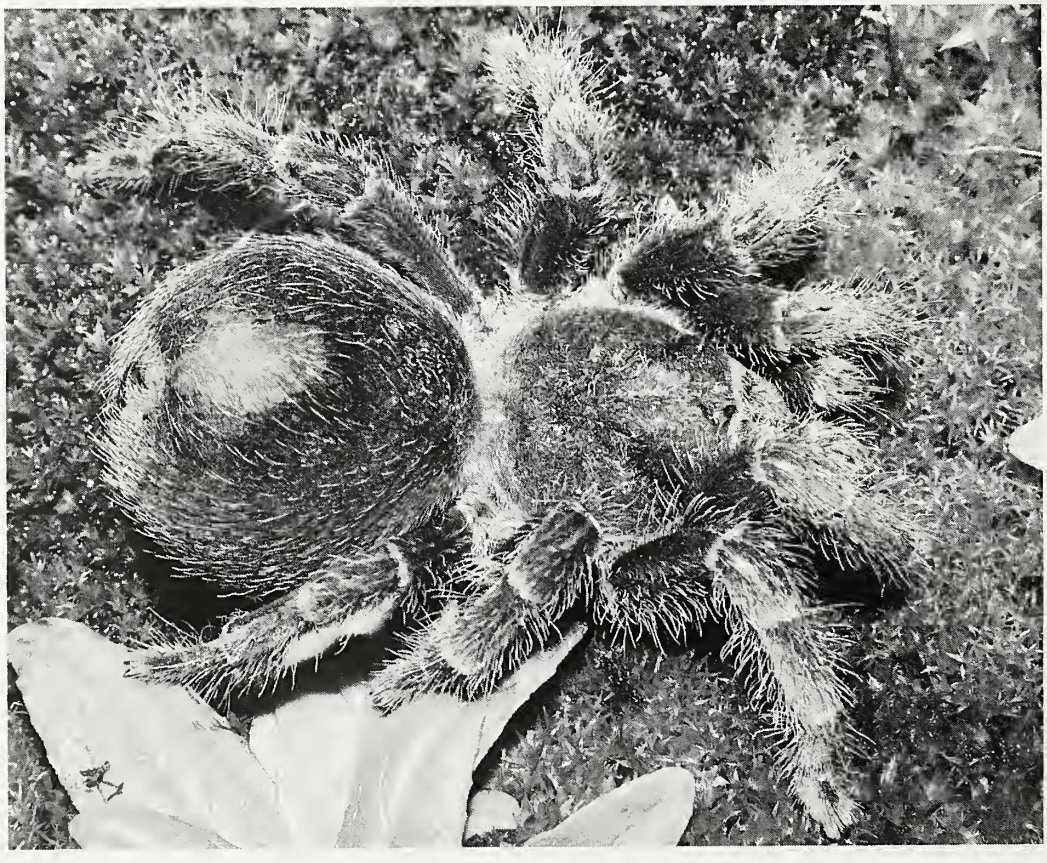


Figure 9.—Female *A. tota*, habitus.

Table 1.—*Agnostopelma tota* sp. n., male holotype, length of legs and palpal segments.

	I	II	III	IV	Palp
Femur	9.1	7.7	7.4	8.1	5.3
Patella	3.7	3.7	3.3	4.1	2.8
Tibia	7.5	5.8	5.2	6.5	3.0
Metatarsus	4.5	4.4	7.0	9.3	—
Tarsus	4.1	3.9	3.7	4.3	1.7

Table 2.—*Agnostopelma tota* sp. n., female paratype, length of legs and palpal segments.

	I	II	III	IV	Palp
Femur	7.5	6.5	5.9	6.9	6.0
Patella	4.3	4.3	4.1	4.2	3.7
Tibia	5.2	4.2	3.5	4.6	4.0
Metatarsus	3.0	3.7	4.7	6.6	—
Tarsus	2.2	2.0	2.3	2.8	3.5

piriform, with prolateral superior and inferior keels (Figs. 7, 8). Length of leg and palpal segments in Table 1, femora III slightly incrassate. Spination: femora I–IV and palp 0. Patellae I–IV and palp 0. Tibia I, 5V 1D; II, 4V 1R; III, 5V 6P 2R; IV, 7V 5P 5R; palp, 1P. Metatarsi I, 5V 2R; II, 5V 2P 1R 2D; III, 12 V 6P 3R 3D; IV, 20V 10P 4R. Tarsi I–IV and palp 0. Color: Cephalothorax, legs, and abdomen dorsally dark brown, ventrally lighter; longer hairs with lighter tips all over abdomen and legs. Types III and IV, urticating hairs present; urticating hairs of intermediate length and morphology between III and IV present.

Female (Fig. 9): Total length, excluding chelicerae and spinnerets, 24.1. Carapace length 11.1, width 11.0. Anterior eye row slightly procurved, posterior recurved. Eye sizes and interdistances: AME 0.28, ALE 0.44, PME 0.30, PLE 0.54, AME–AME 0.34, AME–ALE 0.20, PME–PME 0.96, PME–PLE 0.12, ALE–PLE 0.24, OQ length 1.06, width 1.88, clypeus 0.10 wide. Fovea transverse, straight, width 2.80. Labium subsemicircular, anterior edge curved, length 1.80, width 2.0, with 6 cuspules in a group in the center of the anterior half. Maxillae subrectangular, anterior prolateral and posterior retrolateral angles with 97/101 cuspules in group on the proximal prolateral angle. Sternum length 5.0, subcircular, posterior sigilla oval, narrow, submarginal, long setae on the periphery. Chelicerae with 11 teeth on the promargin, basal teeth absent, intercheliceral tumescence absent. Scopula: tarsi I–II densely scopulated; I distally divided with longer conical setae, II divided by wide band of such setae; III slightly scopulated, divided with longer conical setae; and IV without scopula but with long, conical setae and a lower layer of few curved setae (Figs. 1, 2). Metatarsi I–IV not scopulate. Length of leg and palpal segments in Table 2. Femur III not incrassate. Spination: femora I–IV and palp 0. Patellae I–IV and palp 0.Tibia I, 0; II, 0; III, 1V 2P 1R; IV, 1V 2P, palp 2V. Metatarsi I, 2V; II, 3V 4P; III, 8V 6P 7R; IV, 10V 9P 4R. Tarsi I–IV and palp 0. Two tubular spermathecal receptacles fused at their bases (Fig. 10). Color: cephalothorax, legs, and abdomen dorsally dark brown, ventrally lighter; longer hairs with lighter tips all over abdomen and legs. Types III and IV, urticating hairs present; urticating hairs of intermediate length and morphology between III and IV, present.

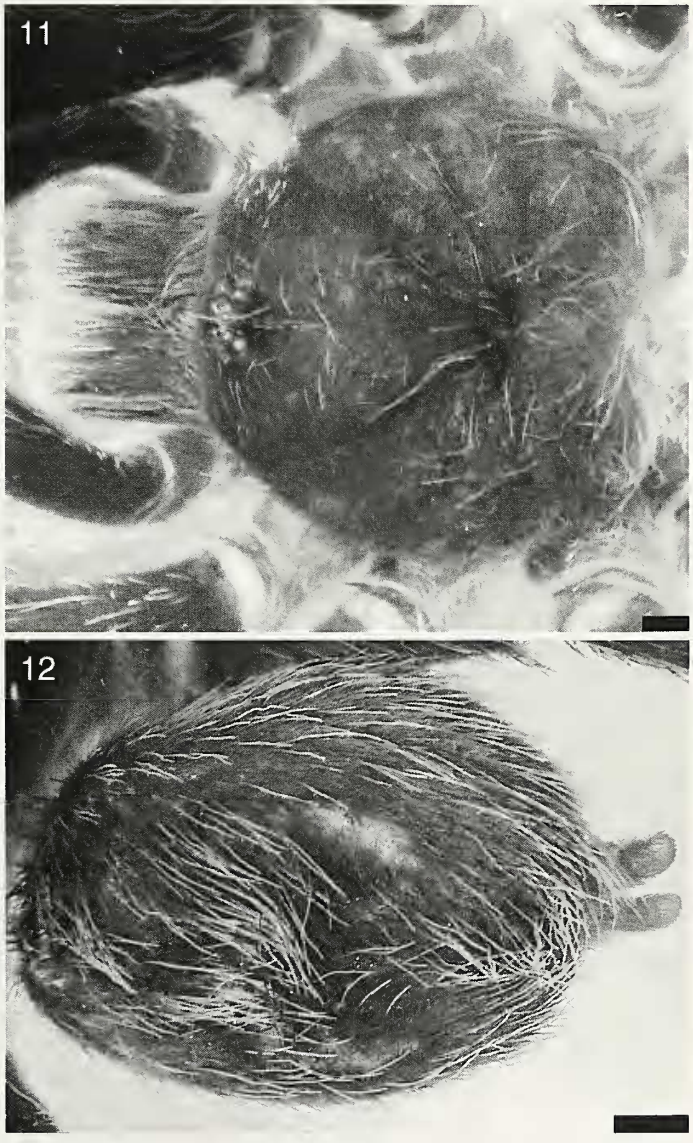
Agnostopelma gardel Pérez-Miles & Weinmann new species
Figs. 11–17, Tables 3, 4

Types.—COLOMBIA, holotype male, *Dep. Boyacá*: Belen (road to Soata) (6°19′60″N, 72°42′0″W), 3 August 1997, D. Weinmann & F. Pribik. Paratypes: two females from same locality. All specimens deposited in FCE.

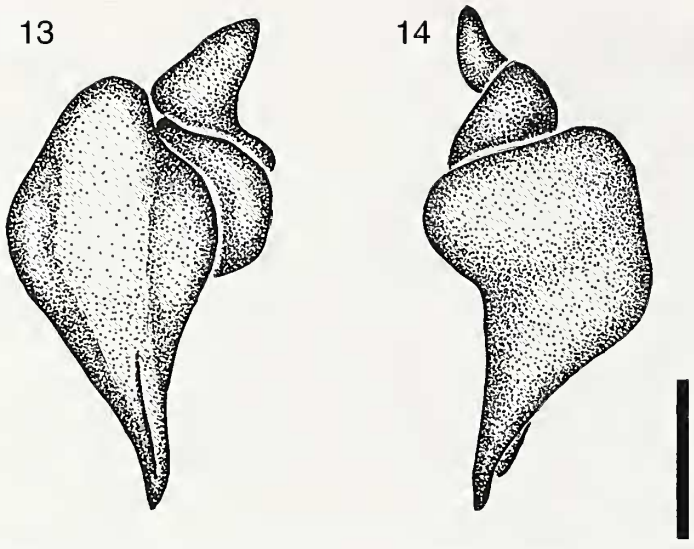
Etymology.—The specific epithet is a noun in apposition, which refers to the most famous Uruguayan tango singer, Carlos Gardel, born in Tacuarembó (1887) and died in Medellín, Colombia (1935).

Diagnosis.—Males differ from those of *A. tota* in presence of clear bands on leg articulations (patellae, tibiae, metatarsi) and in smaller number of maxillary cuspules (46–84). Females differ in separated spermathecal receptacles (Fig. 17) and in the presence of basal teeth on chelicerae.

Description.—*Holotype male* (Figs. 11, 12): Total length, not including chelicerae or spinnerets, 17.0. Carapace length



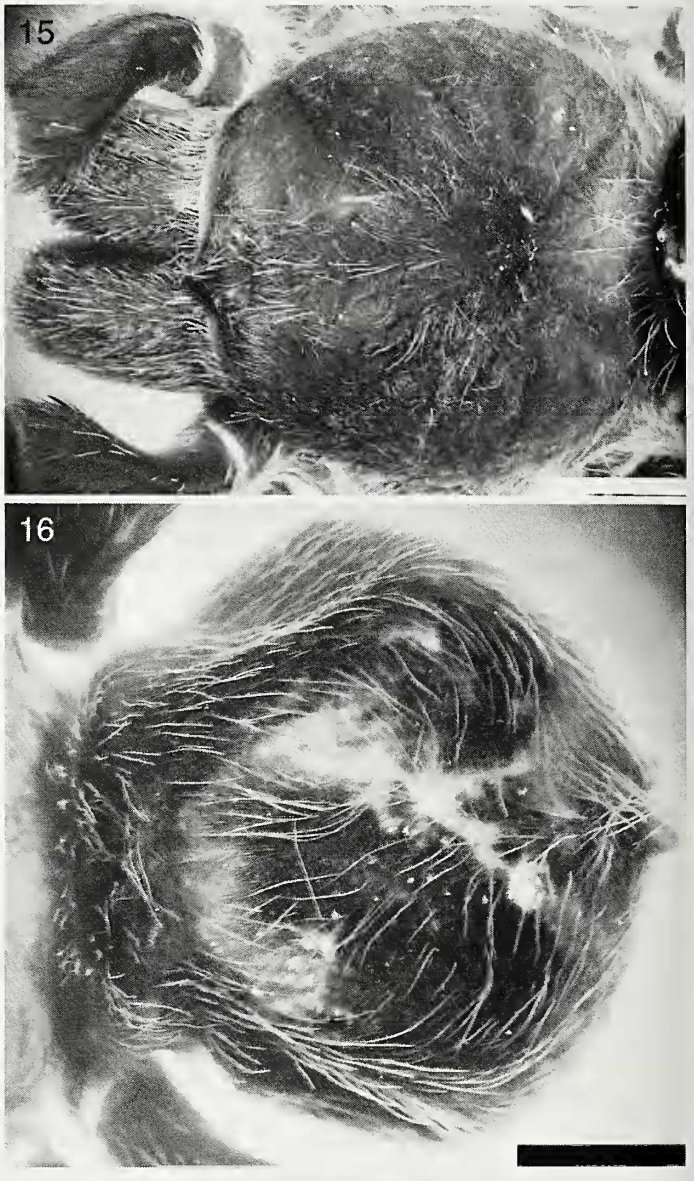
Figures 11, 12.— *Agnostopelma gardel* male, dorsal view. 11. (Top) Carapace; 12. (Bottom) Abdomen. (scales = 1 mm).



Figures 13, 14.— Left palpal organ of male *A. gardel*. 13. (Left) Prolateral view; 14. (Right) Retrolateral view (scale = 1 mm).

8.7, width 8.5. Anterior eye row slightly procurved, posterior recurved. Eye sizes and interdistances: AME 0.26, ALE 0.44, PME 0.20, PLE 0.30, AME–AME 0.22, AME–ALE 0.08, PME–PME 0.68, PME–PLE 0.06, ALE–PLE 0.14, OQ length 0.70, width 1.36, clypeus 0.12. Fovea transverse straight, width 2.30. Labium sub-semicircular, anterior edge notched, length 1.40, width 1.50, with 1 cuspule near anterior edge, maxillae subrectangular, anterior prolateral and posterior retrolateral angles produced, with 84/77 cuspules in a group in the proximal prolateral angle. Sternum length 4.0, subcircular, posterior sigilla, oval, submarginal long setae all over the surface. Chelicerae with 11 teeth on the promargin, plus 6 smaller teeth on the retromargin; intercheliceral tumescence absent. Scopulae: tarsi I–II densely scopulated; I distally divided with longer conical setae, II divided by wide band of such setae; III slightly scopulated, divided with longer conical setae; and IV without scopulae but long conical setae with a sparse lower layer of curved setae (as in female *A. tota*: Figs. 1, 2). Metatarsi I and II scopulate on their apical quarter, III and IV ascopulate. Tibia I without apophysis. Palpal organ piriform, with prolateral superior and inferior keels (Figs. 13, 14). Length of leg and palpal segments in Table 3, femora III incrassate. Spination: femora I–IV and palp 0. Patellae I–IV and palp 0. Tibia I, 4V 2P 1R; II, 3V 2P 1R 2D; III, 5V 2P 1R, 2D; IV, 6V 4P 2R; palp 0. Metatarsi I, 6V 2P 2R; II, 7V 4P 2R; III, 8V 7P 3R; IV, 12V 7P 8R. Tarsi I–IV and palp 0. Color: cephalothorax, legs, and abdomen dorsally dark brown, ventrally lighter, clearer bands on leg articulations (femur, patellae, tibia metatarsi), longer hair with lighter tips all over abdomen and legs.

Female (Figs. 15–17): Total length, excluding chelicerae and spinnerets 28.0. Carapace length 12.5, width 12.5. Anterior eye row slightly procurved, posterior recurved. Eyes sizes and interdistances: AME 0.28, ALE 0.40, PME 0.24, PLE 0.64, AME–AME 0.52, AME–ALE 0.08, PME–PME 1.20, PME–PLE 0.14, ALE–PLE 0.20, OQ length 0.96, width 1.96, clypeus 0.16. Fovea transverse, straight, width 3.50. Labium sub-semicircular, anterior edge slightly notched, length 2.50, width 2.5, with 3 cuspules near the anterior edge, maxillae sub-



Figures 15, 16.—*Agnostopelma gardel* female, dorsal view. 15. (Top) Carapace; 16. (Bottom) Abdomen (scales = 5 mm).

rectangular, anterior prolateral and posterior retrolateral angles produced, with 63/56 cuspules in a group on the proximal prolateral angles. Sternum length 5.3, sub-circular, posterior sigilla oval, narrow, submarginal, long setae all over

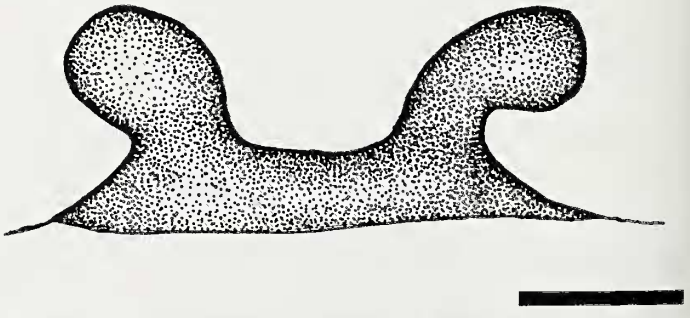


Figure 17.—Spermathecae of female *A. gardel*, ventral view (scale = 1 mm).

Table 3.—*Agnostopelma gardel* sp. n., male holotype, length of legs and palpal segments.

	I	II	III	IV	Palp
Femur	8.8	8.5	8.1	8.8	5.6
Patella	4.2	4.2	3.8	4.4	3.5
Tibia	7.5	6.4	5.5	7.5	3.9
Metatarsus	5.3	5.5	7.4	10.5	—
Tarsus	3.5	3.6	3.7	4.3	2.3

Table 4.—*Agnostopelma gardel* sp. n., female paratype, length of legs and palpal segments.

	I	II	III	IV	Palp
Femur	9.5	8.8	7.5	9.5	7.6
Patella	5.1	4.6	4.3	5.2	4.6
Tibia	7.2	5.3	4.7	6.3	5.5
Metatarsus	3.3	3.6	5.4	8.1	—
Tarsus	2.5	2.3	2.3	3.4	3.8

the surface. Chelicerae with 11 teeth on the promargin, 6 smaller teeth on the retromargin. Scopulae: tarsi I–II densely scopulated; I distally divided with longer conical setae, II divided by wide band of such setae; III slightly scopulated, divided with longer conical setae; and IV without scopulae but with long conical setae and lower layer of a few curved setae (as in *A. tota*, Figs. 1, 2). Metatarsi I–IV ascopulate. Length of leg and palpal segments in Table 4. Femur III not incrassate. Spination: femora I–IV and palp 0. Patellae I–IV and palp 0.Tibia I, 3V; II, 3V 1D; III, 2V 2P 1R 1D; IV, 7V 3P 2R; palp 2V. Metatarsi I, 2V; II, 3V 2P; III 6V 5P 2R 4D; IV, 6V 3P 6R 4D. Tarsi I–IV and palp 0. Two tubular spermathecal receptacles not fused at their bases (Fig. 17). Color: cephalothorax, legs and abdomen dorsally dark brown, ventrally lighter, clear bands on leg articulations (femur, patella, tibia, metatarsus); longer hairs with lighter tips all over the abdomen and legs.

DISCUSSION

Agnostopelma has an unusual tarsal scopula condition, unknown up to now within the Theraphosinae and here considered as a generic apomorphy. Theraphosid tarsal scopulae can be entire, with homogeneous spatulate setae, or divided by a longitudinal stripe of conical longer setae; this division is related to spider size in most Theraphosinae (Pérez-Miles, 1994), but not in the Ischnocolinae (Guadanucci, 2005). The Ischnocolinae genus *Acanthopelma* F.O. Pickard-Cambridge 1897 has different tarsal scopulae, as indicated, but Raven (1985) divided them by rigid spiniform bristles, although they obviously lack the apomorphies of Theraphosinae (urticating setae, keels on palpal organ, subtegulum extended). Ontogenetic changes have been reported for some theraphosids that have divided scopulae as juveniles and entire ones as adults (Gerschman de Pikelin & Schiapelli 1973; Pérez-Miles 1994). Anterior-posterior gradations were also described in the condition of the tarsal scopulae (ranging from entire in forelegs to divided in hind legs) Raven (1985), which suggests the importance of examining each tarsus, as Guadanucci (2005) did with Ischnocolinae.

Agnostopelma scopulae exhibit anterior-posterior gradations with an increased division from leg I to III and absence on leg IV, along with dominant conical setae. These conical setae are similar to those of the medial stripe found in divided scopulae (called *type b* hairs in lycosids by Rovner 1978) and were stated to have more of a traction function than an adhesive one by Pérez-Miles (1994). This characteristic suggests walking rather than climbing habits for *Agnostopelma* species. Recently Gorb and coworkers (2006) described tarsal silk-like secretions with possible adhesive functions for the tarantula *Aphonopelma seemanni*. If this secretion were confirmed in other theraphosids, *type b* hairs could help to lift the tarsi.

Other uncommon characters are present in this genus, such as a reduced number of labial cuspules, also found in *Tmesiphantes* Simon 1892, *Hapalotremus* Simon 1903, *Melloleitaoina* Gerschman & Schiapelli 1960, and some species of *Paraphysa* Simon 1892. Another uncommon character shared with *Magulla* is the presence of very short tarsi in females. The morphology of the spermathecae is very different from all known theraphosid genera, with two divergent digitiform receptacles fused at their base. By the presence of type IV urticating hairs, *Agnostopelma* could probably be placed in the basal group of the Theraphosinae (Pérez-Miles 2000), which also includes *Grammostola* Simon 1892, *Paraphysa*, *Homoeomma* Ausserer 1871, *Plesiopelma* Pocock 1901, and *Maraca* Pérez-Miles 2006 (previously *Iracema*). *Cyriocosmus* is now not considered to belong in this group because it lacks type IV urticating hairs (Fukushima et al. 2005). With a palpal bulb morphology consisting of only one keel, *Agnostopelma* seems to be more similar to *Maraca* than to other genera in this group.

The capture sites are about 3000 m above sea level and have an annual mean temperature of 11° C. All specimens were found in shelters under stones.

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